

## STANDARDIZED INTERIM PROGRESS REPORT

### A. Project Identifiers:

- 1) Award Number: NA17FX1429
- 2) Grant Program / CFDA: 11.439
- 3) Name of Recipient Organization: Texas A&M Research Foundation
- 4) Principal Investigator: Markus Horning
- 5) Project Title:  
Satellite-Linked Life History Transmitters in Steller Sea Lions: Assessing the Effects of Health Status, Foraging Ability and Environmental Variability on Juvenile Survival and Population Trends.
- 6) Funding: Federal: \$1,046,906 Match: \$ 19,500  
(excluding NOAA holdback for NMFS tasks)
- 7) Award Period: June 1st, 2001 through May 31st, 2004
- 8) Period Covered by this Report: December 1st, 2001 through June 30th, 2002

## B. Project Summary:

One of the leading hypotheses for the continuing decline of Steller sea lions in the Aleutian Islands (AI) and Gulf of Alaska (GoA), is a decrease in juvenile survival by 10 - 20%. Nutritional stress related to a reduced juvenile foraging efficiency has been hypothesized as a possible cause for reduced juvenile survival. The hypothesized reduction in juvenile survival, however, is derived from a model based on a Leslie population matrix. This matrix is in turn based on observed rates of decline, observed changes in average age of adult females, and estimates of age-specific fecundity. This hypothesized reduction in juvenile survival, resulting in a reduced recruitment into the reproductively active rookery population, has been used to focus investigative efforts relating to the Steller sea lion decline primarily on juvenile animals. To warrant a continued focus of investigative effort on juvenile Stellers, juvenile mortality figures need to be accurately determined.

Mortality figures are key indicators of future population trends, and are crucial data for the management of endangered species and those potentially exposed to detrimental ecological and anthropogenic environmental changes, or climate related regime shifts. In addition, data on individual survivorship is needed to assess the efficacy of programs designed to ameliorate the impact of such changes and shifts. Survival of juvenile animals is bound to impact recruitment and thus reproductive output of rookeries. On a population level, survival figures are integrators over several possible proximate effects that could contribute to the population decline, such as disease and pollution, predation as well as a reduction in foraging efficiency due to changes in prey abundance and/or quality. Thus, survival figures can be utilized to monitor a population, irrespective of which proximate causes contribute (with some exceptions) to the population decline. Furthermore, mortality rates are expected to reflect nutritional stress or other proximate factors detrimental to a population several years before ultimate effects such as reduced pupping rates / pup counts become apparent (the latter presumably through a drop in recruitment).

We will specifically measure juvenile mortality, and thus directly test a crucial component of the leading hypothesis for the continuing population decline in Stellers, using implanted Satellite-linked Life History Transmitters (LHXs). Mortality transmitters are a well established technique to determine survival rates in wild animals. Our approach is new in that conventional mortality transmitters are externally attached and typically utilize VHF radio transmission. Several problems are associated with such devices: on pinnipeds and seabirds, external units do not remain attached beyond the annual molt, limiting tracking to a maximum of one year. Battery-size and -capacity constraints also limit the life span of such units. Implanting mortality transmitters avoids long-term attachment problems. Implanted telemetry devices have been successfully used on a wide range of marine endotherms, and circumvent external attachment limitations. However, reception range and thus area coverage from VHF implants is reduced compared to external devices. Transmitting life span is still limited to 2-3 years.

A new solution to extend coverage range for mortality transmitters is the use of satellite-linked devices. Satellite-linked data loggers, using the Service ARGOS system aboard NOAA satellites for obtaining location fixes and transmission of stored data have been successfully and extensively used on oceanic vertebrates. At present however, transmission to a satellite from implanted devices is not feasible. To circumvent this problem, the concept of implanted, satellite-linked, delayed transmission life history transmitters (LHX tags) has been developed at Texas A&M University's Laboratory for Applied Biotelemetry & Biotechnology. LHX devices continuously monitor up to five built-in sensors to establish death of an instrumented animal, then store time and date of death in memory. Subsequently, an LHX device transmits this and other previously stored data to an orbiting ARGOS satellite, once the positively buoyant device has been released from the decomposing or consumed body. Through the absence of *any*

transmissions, until after death and release of the device, battery life is greatly extended to well beyond five years, typically 8-10 years.

We will implant satellite-linked life history transmitters (LHX tags) into 60 free-ranging juvenile Steller sea lions, and an additional 12 animals temporarily held at the Alaska Sea Life Center. We will perform comprehensive assessments of the status of body condition, health and immune system, and pollutant levels. From the LHX tags we will determine: time and date of death and weekly cumulative foraging effort from implantation until death.

In a new experimental paradigm, we will analyze differences between survivors and non-survivors in condition and health status at the time of release, as well as seasonal, interannual and ontogenetic dive effort. We will test the predictive power of health, condition and behavioral parameters measurable after weaning, on future survival and thus population trends.

### **C. Summary of Progress and Results:**

#### Non-scheduled activities:

A permit to conduct the proposed research under the MMPA / ESA has been applied for under the leadership of the Alaska Sea Life Center (ASLC). This permit is currently in review. A separate permit under the MMPA has been applied for by the LABB to conduct early testing of LHX implants on rehabilitated California sea lions – a surrogate species – at the Marine Mammal Center at Sausalito, CA (this testing is funded separately). This permit is currently under review.

#### Tasks scheduled for the reporting period:

These tasks were scheduled for this reporting period:

Task 1 (months 1-10): Preparation and calibration of SMX tags.

Task 2 (months 1-10): Preparation and design of health assessments.

Task 3 (months 11-22): tag implants and health assays on 12 transient Stellers at ASLC.

Task 4 (months 11-22): health assays on 12 control animals at the ASLC.

Task 1 had been delayed as of the last progress report, as a result of a joint decision between the LABB and Wildlife Computers to change to a new tag design for the implanted, satellite-linked life history transmitters (LHX tags). We have now completed the integration of the new board design into the new tag. We have completed antenna design and packaging of the new tags, and are nearing completion of the bench testing program of the new tag. We will have the first series of tags ready for deployments by September of 2002. This progress has reduced the amount of delay we have experienced in the technical development of the LHX tags, and we expect to fully complete this task by September of 2002.

Task 2 has been completed successfully.

Task 3 and 4:

These two tasks are contingent upon the availability of juvenile Steller sea lions captured in the wild to be brought into the ASLC for temporary captivity. The "transient" Steller program at the ASLC is currently delayed for two reasons: the required permit has not been granted yet by the Office of Protected Resources, NMFS, and the construction of the holding facility at the ASLC has not been initiated. This construction will likely not be started until the permit is granted. 12 of these "transient" Stellers will be used for the implantation of LHX tags, and another 12 will be used as controls. Since there is a limit to the number of animals that will be brought into the ASLC at one time under this program, these two tasks are scheduled to occur over the course of the next year, although this period may have to be extended. We are still hopeful that the permit will be granted soon, and that we can initiate these two tasks within the next 6-12 months.

#### **D. Problems:**

Task 1 had been previously delayed, as outlined in a prior report. We have since made good progress in task 1 and partially caught up with the delay, and will entirely catch up and complete task 1 by September of 2002. This delay is however not holding back the LHX project at this stage, since we are experiencing additional delays in the implementation of the "transient Steller capture program" at the ASLC, as well as early LHX tag trial on rehabilitated California sea lions at the Marine Mammal Center at Sausalito, CA, under a separately funded project:

The current delay is to some extent related to the delay in obtaining the TWO required permits to conduct the LHX project. One permit (under MMPA and ESA) relates to all work on Steller sea lions and has been applied for under the leadership of the ASLC. The second permit (under MMPA) relates to work on California sea lions, and has been applied for by the LABB. Upon early review by the NMFS permit office, we were told that the authorization to proceed with LHX implants on Stellers would be – once issued – contingent upon successful application of LHX technology in early trials on California sea lions. Not anticipating this contingency, the California sea lion permit was applied to later than the Steller permit. This permit is now under review. This was in part our fault and also a result of some communications problems between my LABB, the ASLC and NMFS. We have now apparently resolved these issues and are awaiting review of these permits. This delay aside, the first LHX implant work under this NMFS SSLRI grant will be performed on the "transient Stellers" to be captured by and held at the ASLC. Construction of the holding facility for these animals will likely not commence until the permit is issued, so there may be further delays down the line.

In the meantime however we are actually benefiting from these delays, by having more time to refine the LHX tags (in the lab) and more time to refine the surgical procedures on rehabilitated California sea lions. As a result, we currently do not see these continuing delays as a problem.

We are now anticipating to start performing LHX implant procedures on California sea lions at the Marine Mammal Center as early as October of 2002. This would allow us to initiate implants of LHX tags into Stellers at the ASLC as early as spring / summer of 2003.